Methods for Assessing Information Needs of Clinicians in Ambulatory Care

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ABSTRACT

Clinical information systems that provide physicians with relevant information at the time and place where decisions are being made can positively affect the quality and cost of health care. We have developed an assessment methodology to study clinicians' information needs in the context of the work flow and operational constraints of the ambulatory care practice environment. We employed a combination of methods, including observational studies, process flowcharting, semi-structured interviews, and surveys to comprehensively define clinicians' needs. Results from our study point to functional requirements not commonly found in hospital-based systems, such as access to problem lists and medications, computer-based support for health-care team communications, and patient-specific instructions and education.

INTRODUCTION

Although evidence from the literature demonstrates significant value from physicians' use of clinical information systems [1,2,3], achieving these benefits has generally been elusive at sites other than the study sites. Difficulty-of-use, inconvenient access to workstations, inadequate training, and lack of a critical mass of useful clinical applications all represent significant impediments. Attempts to mandate physician use of systems without overcoming these impediments and without considering work flow issues can lead to significant user resistance [4]. We seek to increase use of computers by clinicians by enhancing the value of information retrieved, and at the same time, by reducing the impediments.

We conducted a study to understand the information needs of clinicians in the ambulatory care setting. Our study focuses on a variety of clinical practice settings in ambulatory care, including primary care faculty group practice, primary care private group practice, primary care urban clinic for the underserved, and specialty care faculty group practice. In this paper, we report on our methodology and initial results from our study of the first clinical site, a general internal medicine faculty practice clinic.

The literature emphasizes the importance of integrating decision support with routine practice [5]. Most of the studies demonstrating benefits of clinical decision support were done in the inpatient setting, or in hospital-based clinics, often focusing on use by physicians-in-training [1,2,3,6,7,8,9]. Under managed care, the outpatient setting is the primary focus. Studies of physicians-in-training may also not necessarily generalize to the broader practicing physician community. Our project concentrates on providing networked access to data for experienced attending physicians and multi-disciplinary health care teams in ambulatory care practice outside of the hospital.

In addition, we focus on the needs of multi-disciplinary health-care teams to coordinate patient care across the continuum, despite the physical separation of the team members themselves and the remote location of the patient. In the past, health care teams were based within a hospital where communication was facilitated by physical proximity. In the new delivery environment, where the outpatient setting is the primary site of care, the health care team can no longer rely on serendipity for timely communication of patient information and coordination of patient care tasks.

Like others who have taken a user-centered approach to design [10], we have deliberately made comprehensive user needs assessment a central part of our design and development process. Observational studies have shown that practitioners' perceptions of their information needs often differ qualitatively and quantitatively from actual practice [11]. When input from ethnographic studies is applied to the design of computer-based clinical applications, favorable results can be achieved [12,13]. Based on the value of observational study data [14], we centered our multi-method assessment approach on observational methods. Others have used observation, but on a more informal basis [15]. As part of our assessment process, we are developing formal tools for conducting observational studies in ambulatory care.

We expect that by basing the design and specification of a clinical information system on a more comprehensive clinical and operational information

needs assessment sensitive to work flows, we will be in a better position to develop information tools that integrate well into routine practice.

CLINICIAN INFORMATION NEEDS ASSESSMENT METHODOLOGY

We conducted a comprehensive study of the General Internal Medicine (GIM) Clinic of a large faculty group practice. The number of practicing clinicians included 29 faculty physicians, 64 residents, and 2 nurse practitioners. Eighty percent of the patients were returning patients, known to the clinic. Lab-test results and radiology reports were available through PRIMES, the Northwestern Memorial Hospital (NMH) results reporting system.

As part of NMH's broader clinical information systems initiative, we have formed a multi-disciplinary clinical evaluation team consisting of professionals in medicine, nursing, informatics, business, and management engineering. This team of clinicians was responsible for designing and conducting this study.

In the following four subsections, we describe our user needs assessment methods: 1) Observational studies, 2) Process flowcharting, 3) Semi-structured interviews, and 4) Surveys.

Observational Studies

Members of the clinical evaluation team conducted direct observations of clinicians and other clinic personnel during normal clinic operation. We "shadowed" the subjects for two to four hours, and manually recorded notes on every activity observed. We conducted observations of 30 clinicians over an eight-week period. Health-care team subjects were selected using stratified, random, purposeful sampling.

Only clinician members of the research team followed physicians into the exam room with the patient. Neither patient- nor physician-identifying information was recorded. Institutional Review Board approval was obtained for observations to occur in the exam room with the informed consent of the patient.

Figure 1: Observational Data Coding Framework

Event	By Whom/By What	With Whom/With What	Why	When	Interruption
A	B	C	D	E	F
1. Completing forms	1. Attending	1. Attending	1. Patient/About patient	1. Down Time/Between pts	Y=Yes
2. Looking for s/t - successful	2. Billing Coordinator	2. Billing Coordinator	2. Appointment schedule	2. During check in	N=No
3. Looking for s/t - unsuccessful	3. Clinical Nurse Specialist	3. Clinical Nurse Specialist	3. Assistance	3. During checkout	
4. On the telephone	4. Clinical Practice Manager	4. Clinical Practice Manager	4. Case review/Consultation	4. Prior to exam	
5. Reading things	5.Fellows	5.Fellows	5. Changeover/shift change/coverage	5. During exam	
6. Talking	6. Housestaff/Resident	6. Housestaff/Resident	6. Charge voucher	6. Following exam	
7. Transporting	7. LPN	7. LPN	7. Chart	7. Nursing workflow	
8. Waiting	8. Managed Care Coordinator	8. Managed Care Coordinator	8. Documentation		
9. Writing notes/Writing	9. Medical Assistant	9. Medical Assistant	9. Dictating		
10. Managing chart/Copying	10. Medical Receptionist	10. Medical Receptionist	10. Faxing information		
	11. Nurse Manager	11. Nurse Manager	11. Lab requisition		
	12. Nurse Practitioner	12. Nurse Practitioner	12. Lab results		
	13. Patient	13. Patient	13. Maintain note cards		
	14. RN	14. RN	14. Medical Education		
	15. Significant other	15. Significant other	15. Messages		
	16. Other	16. Appt schedule - exam room	16. Paging someone		
		17. Appt schedule - nursing station	17. Paperwork		
		18. Chart/progress note	18. Patient Data: Qualitative		
		19. NMH department	19. Patient Data: Quantitative		
		20. Other physician office	20. Patient Demographics		
		21. Outside service/Pharm/Dir. Asst	21. Patient Escort		
		22. Patient arrival system	22. Patient Instructions/Education		
		23. PDR	23. Patient supplied information		
		24. Phone Directory/List	24. Personal		
		25. Pocket drug reference	25. Phone/pager number/Name		
		26. PRIMES	26. Prescription		
		27. Scheduling system/IDX	27. Radiology Results		
		28. Textbook/Journals/Reference	28. Radiology requisition		
		29. Note Cards/Post It Notes	29. Referral requisition		
		30. Messages	30. Returning page		
		X=Skip category	31. Schedule tests		
			32. Supplies/equipment		
			33. Test results (excl. lab and rad.)		
			34. Verbal orders		
			35. General Information		
			36. Consult Report		
			37. Paperwork Error		
			38. Computer Difficulty		
			39. Forms (Non-specific)		
			x=Skip category		

The researchers' field notes were transcribed into narrative format by the individual researcher, emphasizing information-seeking behaviors and barriers to information access. A coding scheme for the transcripts was developed by iterative refinement (Figure 1). We coded activities by identifying information-related events, the individuals and communication medium involved, the reason for the event, and in what context the event occurred. Clusters of similar behaviors and situations were given a code. New codes were developed until virtually all events could be coded by the defined codes. We then developed a clinician activity matrix, patterned after one described by Overhage [16], as a foundation for the observation coding framework. Their inpatient framework was modified to accommodate the ambulatory setting.

Process Flowcharting

Process flowcharting is a visual tool commonly used to model and evaluate complex processes. We used this tool to gain a better understanding of the patient care process and information flow process, including patient and staff workflow.

Flowcharts graphically display process improvement opportunities and help developers identify information system functional requirements. Current-state flowcharts help identify process deficiencies such as unnecessary steps, delays, redundancies, potential for errors of omission, and duplication of effort. Future-state flowcharts depict a streamlined or redesigned process that may be enabled by information technology. Based on transcripts of the observational data we developed flowcharts of several important processes, including the clinical encounter, the check-out process, and the handling of phone messages from patients.

Semi-Structured Interview

Interviews are an important adjunct to a researcher's data-gathering methodology [17]. They provide an opportunity to obtain a deeper understanding of the processes, problems, and information needs of the health-care team member. We had three global objectives for the interviewing process as follows: 1) validation of information obtained from other data collection techniques; 2) expanding on observational data or exploring new data; and 3) identification of potential functional requirements and measurement opportunities. One-hour, one-on-one interviews were scheduled with a randomly selected set of clinicians. The interviews were conducted in a private office to minimize external distractions, and all interviews were

tape recorded for later transcription. The transcripts of the interviews were then coded according to three dimensions -- processes, problems/issues, and functional requirements.

Surveys

We developed a survey instrument to assess three baseline characteristics: 1) current use and experience with computers, 2) satisfaction with available computing resources in the clinic, and 3) perceived value of various functions of a future information system. The survey consists of 30 closed-end questions using a 5-point Likert-type scale.

A total of 127 surveys were mailed to participants at GIM; 95 (74.8%) were returned by the two-week deadline for replies.

RESULTS FROM GENERAL INTERNAL MEDICINE CLINIC

In the following sections, we report on the preliminary results of the user needs assessment.

Observational Study

We observed 30 clinicians during 95 patient encounters.

Over the 78 hours of observation, we recorded and characterized 1783 activities. The events were divided among several categories (Figure 2) including the following: talking (38%), information-seeking behavior (27%), and completing forms or documenting (20%). The breakdown of the components of "talking" is shown in Figure 3. We further broke out the topics discussed during patient education activities (Table 1).

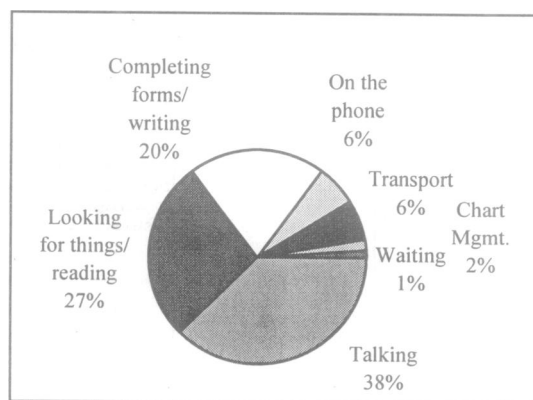**Figure 2: Distribution of Observed Clinician Activities (N=1783)**

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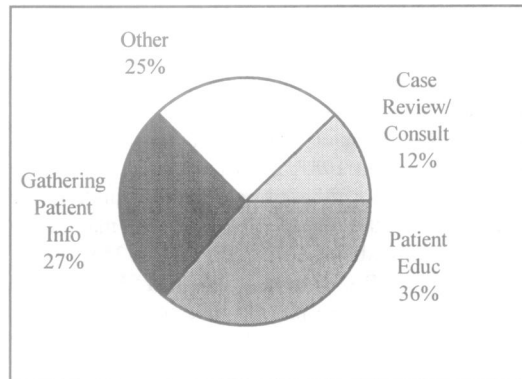**Figure 3: Subcategories of Talking Activities (N=660)**

Figure 4: Clinicians' Satisfaction Ratings with Current Computer Resources (N=70)

Table 1: Distribution of Patient Education Topics Occurring during Patient Encounters (Total N=226)

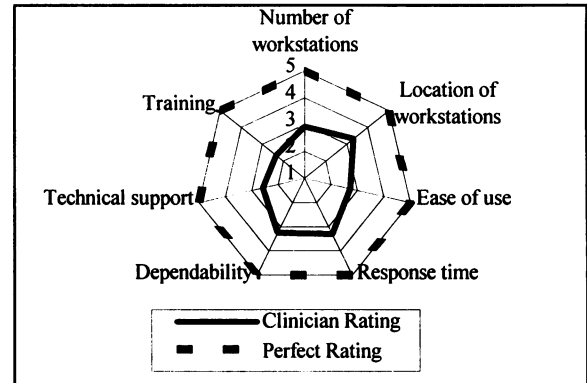| Patient Education Topic	Count	%
Medication Instructions	69	30.5%
Treatment Plans	57	25.2%
Explanation about Diagnosis	32	14.2%
Instructions for Follow-up	31	13.7%
Health Maintenance	26	11.5%
Explanation about Tests	11	4.9%

Interviews

We interviewed 30 clinicians. Two hundred thirty-seven (237) issues were elicited during the interviews. Difficulty finding patient information (e.g., problem lists and medication lists), ineffective communication among health care team members, inadequate computer resources, and unavailable or inconvenient access to patient education materials were among the top issues identified.

Survey

On a scale of 1 to 4 (4=expert), respondants rated their skills an average of 1.9/4.0, suggesting an intermediate level of prior computer experience.

Analysis of the relatively poor satisfaction with current computer resources (depicted in the star diagram in Figure 4) suggest that insufficient number of computers, lack of training, lack of technical support, and poor ease-of-use all contribute to the poor rating.

When asked to rate desirability of potential features and functions of a future computer system, clinicians rated access to diagnostic test results, ability to display a medication list, and ability to retrieve dictated notes highest, on average. Ratings for all potential features ranged from 3.7 to 4.9 on a 5-point scale. A summary of these results is presented in Table 2.

Table 2: Clinicians' Desired Functionality for Future Computer Systems (N=70; 5.0=Extremely Desirable)

Future System Functionality Rating	Avg.
Access to diagnostic test results	4.9
Ability to display a medication list	4.8
Retrieve dictated notes	4.7
Abnormal test result alerts	4.6
Drug interaction alerts	4.6
Access to patient appointment schedules	4.6
Trending of diagnostic test results	4.5
Patient care follow-up reminders	4.5
Patient self-care instructions	4.4
Display and modify the current problem list	4.4
Authenticate dictated notes on-line	4.2
Access demographic information	4.0

SUMMARY

Based on the results from our study of information needs at a faculty-practice General Internal Medicine Clinic, we concluded that we must address the following needs:

1. Need for integrated access to patient information
2. Need for summary information (e.g., problem lists, medications, demographics)

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3. Need for reliable communication among health care team members to coordinate, track, and manage care of individual patients
4. Need for tools to support patient instruction and education
5. Need for convenient access to computer workstations with good training and technical support

While there is significant support in the literature for the needs identified in item numbers 1 and 2, above, items number 3 and 4 have received little attention in deployed products or in the literature. Precisely where workstations need to be placed in order to be "convenient" (item number 5) also requires further study and evaluation. We expect that as we study other sites, we may need to refine these high-priority needs, and perhaps add others. However, the information infrastructure for addressing these needs is not expected to change dramatically.

Our thesis is that better understanding of the health care team's information needs will improve our ability to develop applications that satisfy those needs. We will develop functional requirements for information tools based on the results of our information needs assessment. The functional requirements will exist not only as a written document, but importantly, also exist as personal knowledge acquired by the clinical evaluation team that performed the observation of the subject clinicians *in situ*. Design decisions and tradeoffs are made almost daily during the development process. Having people with first-hand knowledge of the targeted site involved as an integral part of the development team will significantly improve the fidelity with which the applications satisfy the observed needs. The development team will receive constant iterative feedback from the clinical evaluation team and health-care team members at the practice site.

ACKNOWLEDGEMENTS

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